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CONTENTS

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The National Geographic Society, the object of which is the increase and diffusion of geographic knowledge, has a paying membership of 1,000. Its membership is not restricted to geographical specialists, but is open to any person in good standing who may be editorially interested in its work or who desires information. The annual subscription is, for active members, $5.00 per annum; for corresponding members, $2.00 per annum. Active members pay also an initiation fee of $2.00 on election. THE NATIONAL GEOGRAPHIC MAGAZINE is sent regularly to all members, both active and corresponding.

Donations for the founding of Prize Medals and Scholarships are respectfully solicited.

AN IMPROVED METHOD OF KEEPING THE SCORE IN

DUPLICATE WHIST, COMPASS WHIST, STRAIGHT WHIST AND EUCHRE.

Since Duplicate and Compass Whist have come into fashion there has been an unprecedented revival of interest in the game, due to the fact that mere luck is to a large extent eliminated by a comparison of the scores made in the play of the same hands by different players.

The one thing needed to perfect the new method has been a convenient device by means of which the score made on the first round can be concealed until after the replay of the hands, as a knowledge of the first score often enables a good player to make a decisive gain, and matches are lost and won on just such little chances.

A Washington player has at length invented and put upon the market at a very low price a little device which admirably answers the purpose, and at the same time serves as a pretty and useful table ornament, marker, and pencil rest. It is called the "Cosmos Counter," and consists of a little polished wood tablet with a metal keyboard that can be clamped down on the score in such a way as to bring a little metal glides over the 24 spaces in the "score" column of the card, for use in concealing each first score as soon as recorded and until the hand is replayed (in duplicate whist, or the entire series finished (in compass whist).

Whist players will at once see the advantage of this new method of keeping the score, as it effectually prevents their opponents at the same or another table from taking advantage, either by accident or design, of a knowledge of what the hand in capable. The trouble with duplicate whist especially, is that the replay is liable to be influenced by memory of the cards and score, and anything that helps to confuse such recollections is a great gain to fair play.

The "Cosmos Score Card," prepared for use with the counter, shows several new features, such as a heading for both Duplicate and Compass Whist and on the reverse for Straight Whist, Euchre, &c., thus enabling the same counter and score to be used for any game of cards.

Cosmos Counters, with tablet of quartered oak, maple, or birch, and metal in either gold or silver finish, 50 cts apiece; 6 for $2.75; 12 for $5; by mail 4 cts. apiece extra. Cosmos Score Cards, 15 cts. per package of 40; 12 packages for $1.50; by mail free of postage.

Ask to see samples at any stationer's, or order direct from the General Agents.

Cosmos Duplicate Whist Score

N | E

S | W

HAND	COMPASS WHIST SCORE	TOTALS	TRUMP	OPPONENTS	HAND
	DUPLICATE WHIST SCORE	GAIN	TRUMP	GAIN	
1					1
2					2
3					3
4					4
5					5
6					6
7					7
8					8
9					9
10					10
11					11
12					12
13					13
14					14
15					15
16					16
17					17
18					18
19					19
20					20
21					21
22					22
23					23
24					24
TOTALS					TOTALS

Copyrighted 1894, by Kenneth Wells, Washington, D. C. For use with the Cosmos Duplicate Whist Counter, patented July 3, 1894.

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E. MORRISON PAPER CO., 1009 Penna. Avenue, Washington, D. C.

National Geographic Magazine

MOVEMENT

[illegible]

[illegible]

The [illegible] of New Orleans [illegible]

[illegible]

[illegible] A present of [illegible]

[illegible] to the Mohawk valley

[illegible] by three races. Several of these [illegible]

[illegible]

FIG. 1. ANCIENT AND MODERN SETTINGS OF LAKE ERIE

The broken lines show the positions of the shores at two epochs of the lake's history

Lengths of the expansion gates in feet

The broken line shows the original outline of the lake

There is reason to think that the great lakes, Huron, Michigan, and Superior were at first open to the sea, so as to constitute a gulf at that geological moment when the [illegible] Straits of Mackinac [illegible] and Ontario, but lies chiefly above the

present water surface. It has been determined as nearly parallel

[illegible]

to a remarkably uniform dip of 7 inches per mile, in a southwesterly direction, or more exactly, S. 27° W. As will be seen

[illegible]

the surface of Lake Michigan near Green Bay, and below the

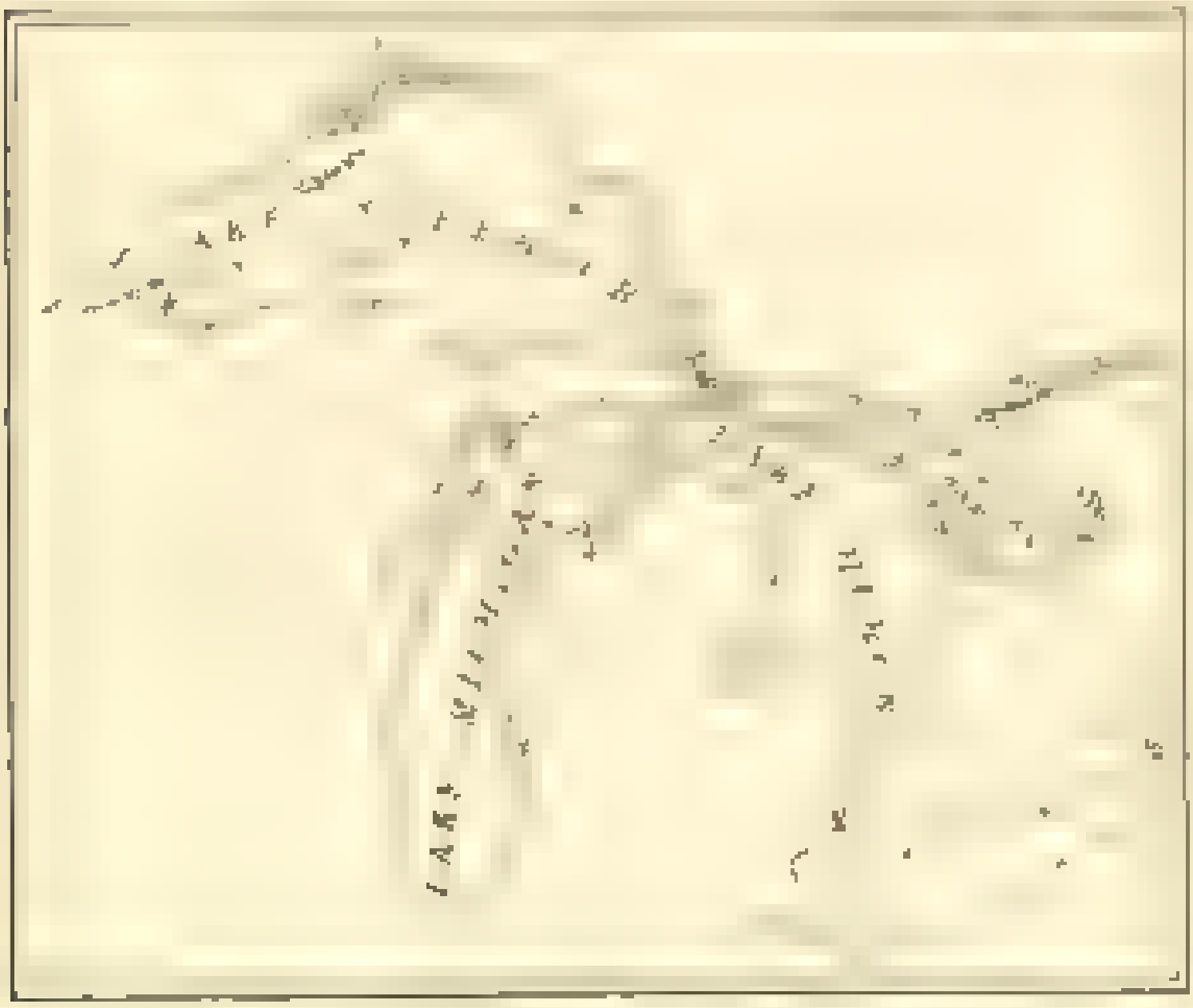


FIG. 4.—STATE BOUNDARIES AND PRINCIPAL LAKE PORTS IN 1911

The boundaries are shown by the broken lines

surface of Lake Huron just north of Saginaw bay. The southward tilting of the land, involving the uplift of the north end of the lake and the water over which the steamers run, has

[illegible]

this movement and a consequence of the uplift caused the

ing the St Marys river, into existence, and eventually the present condition was reached.

[illegible] of the Niagara river that the Niagara time estimates, based on the erosion of the gorge by the cataract, can be applied to them. Lake Erie has existed approximately as long as the Niagara river, and its age should probably be reckoned in tens of thousands or hundreds of thousands of years. Lake Ontario is rather younger; and all that can be said of the beginning of Great Lake Nipissing is that it came long after the beginning of Lake Erie, but the date of its ending, through the transfer of outlet from the Mattawa to the St Clair, is more definitely known. That event is estimated by Taylor to have occurred between 5,000 and 10,000 years ago.*

The lake history thus briefly sketched is characterized by a progressive change in the attitude of the land, the northern and northeastern portions of the region becoming higher, so as to turn the waters more and more toward the southwest. The last change, from Great Lake Nipissing to Great Lakes Superior, Michigan, and Huron, involving an uplift at the north of more than 100 feet, has taken place within so short a period that we are naturally led to inquire whether it has yet ceased. Is it not probable that the land is still rising at the north and the lakes are still encroaching on their southern shores? J. W. Spencer, who has been an active explorer of the old shorelines of the glacial lakes and has given much study to related problems, is of opinion that the movements are not complete, and predicts that they will result in the restoration of the old outlet of Lake Michigan and the drying of Niagara.†

The importance of testing this question by actual measurements has weighed upon me for several years, and I endeavored [illegible] of an elaborate set of observations to that end. Failing in this, I undertook a less expensive investigation, which began with the examination of existing records of lake height as recorded by gage readings, and was continued by the establishment of a number of gage stations in 1896. To understand fully the nature of this investigation it is necessary to consider the difficulties that arise from the multifarious fluctuations to which the lake water is subject.

* [illegible] Taylor, F. B., A short history of the [illegible] Lakes. [illegible]

† Proc. Am. Ass. Adv. Sci., vol. [illegible], p. [illegible].

If the volume of a lake were invariable, and if its water were in perfect equilibrium under gravity, its surface would be constant and level, and any variation due to changes in the height of the land could be directly determined by observations on the position of the water surface with reference to the land; but these conditions are never realized in the case of the Great Lakes, where the volume is continually changing and the water is always in motion. The investigator therefore has to arrange his measurements so as to eliminate the effect of such changes.

Consider first the influence of wind. The friction of the wind on the water produces waves. These are temporary and practically cease in hours of calm, the perpetual ground swell of the ocean is not known on the lakes. The friction of the wind on the water also drives the water forward, producing currents. The water thus driven against the lee shore returns in undercurrents, but the internal friction of the water resists and delays the return, and there is consequently a heaping of the water against lee shores and a corresponding lowering of its level on windward shores. During great storms the difference amounts to several feet, reaching a maximum on Lake Erie. In October, 1880, a westerly gale is reported to have raised the water 8 feet [illegible]

changes of level are much smaller, but they are nevertheless appreciable, and they have even been detected in the case of the gentle "land and sea" breezes which in calm weather are created by the diurnal cycle of temperature change on the land.

The water is also sensitive to atmospheric pressure. If the air pressed equally on all parts of the lake surface the equilibrium of the water would not be disturbed; but its pressure is never uniform. As shown by the isobars on the daily weather maps, there are constant differences of pressure from point to point, and within the length of one of the Great Lakes there often is a difference of several tenths of a barometric inch. A column of mercury 1 inch high weighs as much as a column of water 13 inches high; and whenever the atmospheric pressure at one point on a lake exceeds the pressure at another point by the tenth of a barometric inch the water level at the first point tends to be 1.3 inches lower than the water level at the second point. When a condition of relative [illegible] forms over the water there is a [illegible] of the

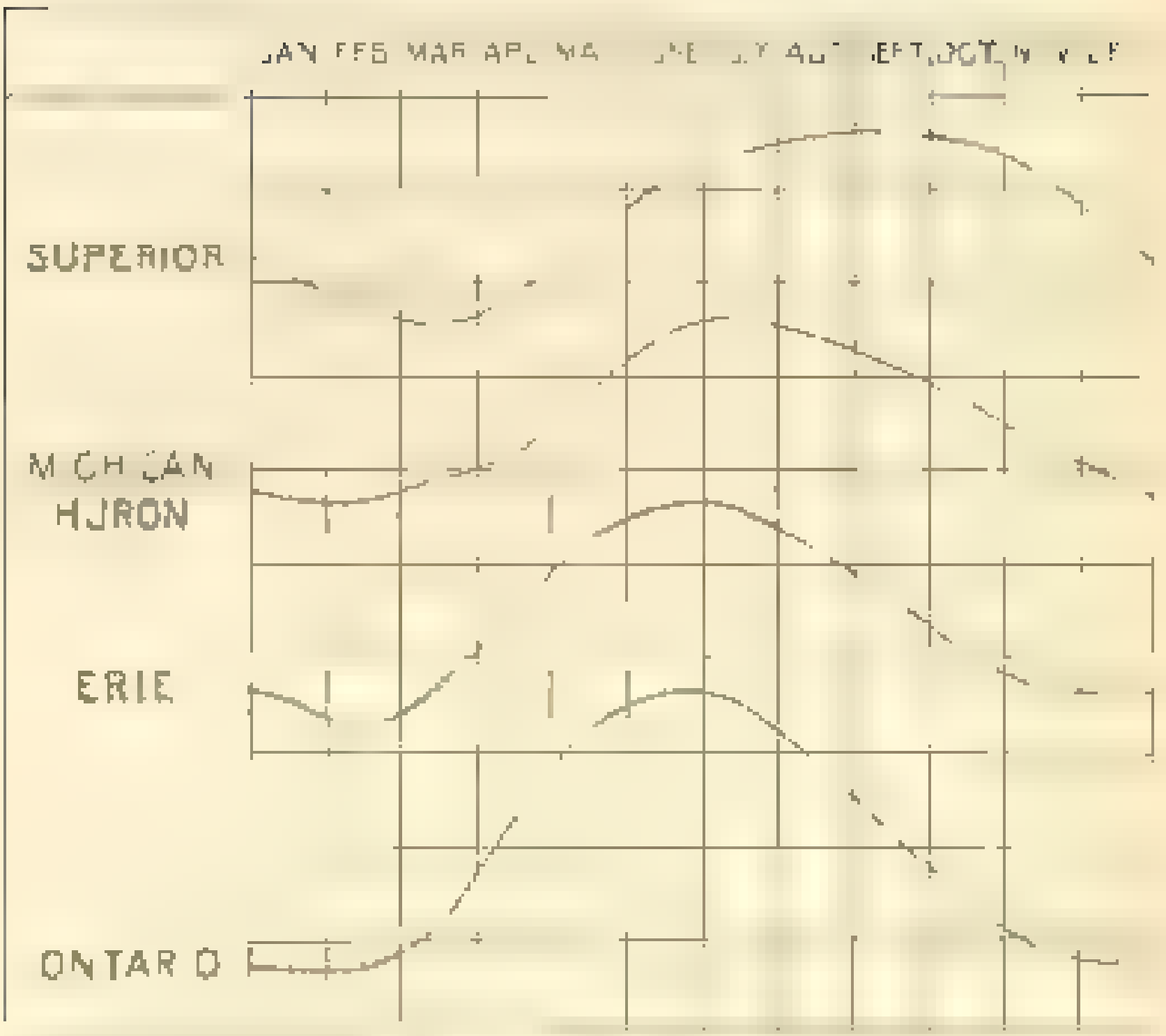
* Science, vol. VIII, pp. 24, 26. "The effect of a storm [illegible]," in Ann. Rept. Chief of Engineers, U. S. A., for [illegible], part [illegible], pp. [illegible].

the coast of Wisconsin. Such an idea still [illegible]

[illegible] lies, except at its lower end, and these waves [illegible] body of water, but are continued by reflection, as though a wall were put up parallel to the wave's direction [illegible] the water's surface [illegible] a considerable portion. The passage of the [illegible] waves across [illegible] body of water [illegible] the waves are also [illegible] the whole body of the lake in motion, so that at every point [illegible] these genuine motions are of [illegible] importance. In the [illegible] the interval from one [illegible] to another. Such [illegible] amounts to several hours, or [illegible] analogy a few minutes, but at the ends of lakes the [illegible] of [illegible].

The lakes, like the ocean, are swayed by the attraction of the sun and moon. The [illegible] are so rich in [illegible] of the ocean, and are even small as compared to the seas, but they [illegible]. At Milwaukee the [illegible] rise [illegible] more than one inch, and the [illegible] at Chicago and Duluth [illegible] to an inch and a half. [illegible] attention at new and full moon to these [illegible].

Water is constantly [illegible] to and from the lakes [illegible] the rate is not uniform. Usually a low [illegible] occurring [illegible] two or more weeks [illegible] quite [illegible] water, and [illegible] [illegible] all the [illegible] they [illegible]. Water is also [illegible] in a [illegible] by man, and [illegible] directly on the lake. It [illegible] the [illegible] evaporation, the rate of which [illegible], [illegible] overall, [illegible] within [illegible] limits. The [illegible] of water contained in the lake, [illegible] just as these quantities [illegible], itself [illegible]. But [illegible] the plot of [illegible] surface the [illegible]. In [illegible] years the [illegible] of variation for Lake Superior [illegible] inches; for Lakes Michigan and Huron, [illegible] inches; for Lake Erie, [illegible] inches; for Lake Ontario, [illegible] inches. Low water occurs nearly [illegible] January or February for all the lakes except Superior, where [illegible] March. High water in general comes on the lower lakes [illegible]



A ship on the ocean. The curvature of the Earth at this distance, 6 ± 8 in. From page from Wonders of the Universe. Whereas the Earth's diameter is 8,000 miles, only a fraction of a mile is perceptible to the human eye. Such vertical space one foot

In the diagram, E represents the earth, A and B two points on its surface, and W the water surface to which the points A and B would be raised if the earth were covered with water. If the height of A above the water at X be accurately measured by the surveyor's level, and also the height of B above the water at X, it is only necessary, then, to know the distance between these two points in order to calculate the curvature of the earth. After a number of such measurements have been made

[illegible]

Y Y, and the length is intermediate of A above Y and of B above [illegible] tive height of A and B, and if earth movement has tilted the [illegible] toward A or B, the change in their relative height may be shown by the difference in the two results of measurement.

As the water is not motionless but in continual motion, the [illegible] of lines of level from A and B to the water does not suffice, and it is necessary to determine from observations on the oscillating water surface what would be its position if still. Such observations are made by means of gages. These [illegible] or zero, close by the water, and a graduated scale by means of which the vertical distance of the water surface from the zero is measured.

Changes in the volume of the lake influence all parts of its [illegible] the measurements it is only necessary that the gage observations at the two stations be synchronous. The effects of wind waves can be prevented by breakwaters. Disturbances due to [illegible] times when there is little wind. The effects of light winds can be approximately eliminated by taking the average of many observations, and so can the effects of seiches and tides. The effects of differences of atmospheric pressure can be computed from barometric measurements of air pressure, and the proper corrections [illegible] of observations at each station can be determined and [illegible] and afterward apply corrections; and the wind and seiche effect may be treated in the same way.

In the investigation I was able to make consideration was given to these various sources of error, but it was not practicable to take [illegible] considerations for avoidance or correction, because the [illegible] of gages was only partly under my control. Gage stations have been established on the Great Lakes at various times and at various places, and the records of readings have been preserved. In some cases the zeros of gages were connected by leveling with bench marks of a permanent character, and in a few in- [illegible]

The most important body of information of this character is contained in the archives of the United States Lake Survey, which were placed at my service by the Chief of Engineers, U. S. A. [illegible]

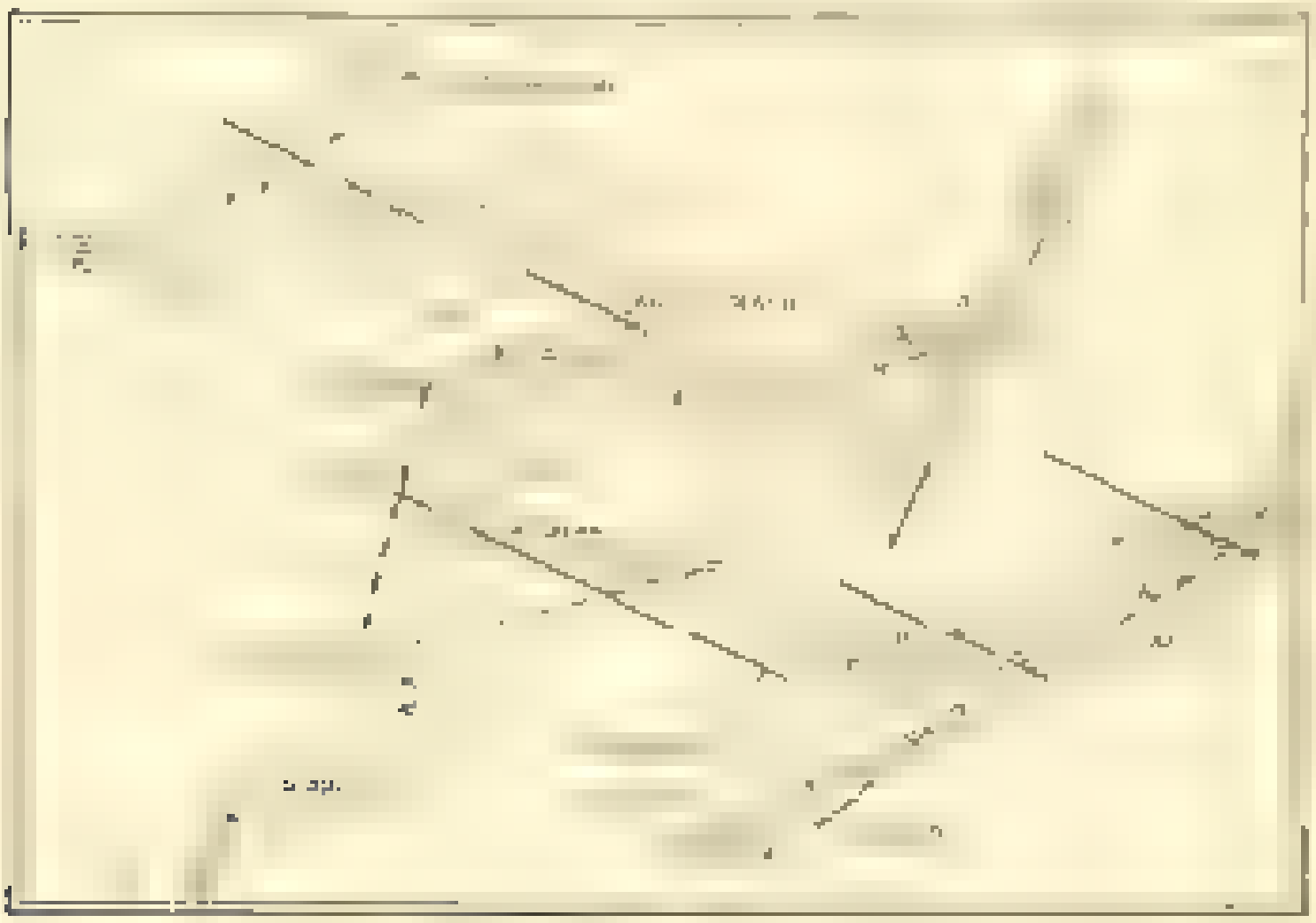


Fig. 1.—[illegible]

at the head of the Detroit river, as compared to a point in the middle of Lake Erie, about 250 feet, or nearly three inches. Between Lake Michigan and its most remote point, Port Arthur, Michigan, on the shore of Lake Superior, the difference of level is 601 feet, or one and one-half inches per mile. The water surface at Escanaba, at the north end of Lake Michigan, is approximately level with a point on Milwaukee, about 600 feet, or about two inches.

There is no doubt that these differences in slope from the Detroit river to Lake Erie and from Escanaba to Milwaukee have existed for many centuries, and that the water surface of Lake Michigan may have been nearly level with the outer ends of the Detroit river and Lake Erie at the time the beach of Grosse Point was formed. Whether the slope of the water surface of the rivers in the early days was greater than it is now, or whether the present slope is due to the deepening of the channels by the action of the current, is a question which can be answered only by observations extending over a long period of years. The evidence is, however, conclusive that the present slope is due to the deepening of the channels by the action of the current.

Summary of Distance, Time Intervals, and Measurements of Differences of Lake Levels

Between	Distance	Time interval	Difference of level	Fall per mile	Fall per 100 miles
Mean level of Lake Michigan and mean level of Lake Superior	601 feet	50 years	601 feet	1.2 inches	10 inches
Escanaba and Milwaukee	600 miles	50 years	2 inches	0.04 inch	0.4 inch
Detroit river and Lake Erie	28 miles	50 years	3 inches	0.1 inch	1 inch

[illegible] the results of the several years work of the Detroit Observatory in connection with the measure direct on of [illegible] and the [illegible] made in the discussion of observations. S. 27° W. In the northeastern [illegible] right of the scale of a little [illegible] miles long shows the [illegible] ly

[illegible] ed in one way, the results are remarkably harmonious. The computed value of [illegible] ge only from 0.37 for [illegible] to

[illegible]

[illegible] here a word in regard to the record of these new tidal gauges at the Grand Lake-breakwater pier. [illegible]

[illegible] light vessel on which has [illegible] taken very [illegible] by measurement [illegible] ge to Sept. 1st, It is proper to note that the fundamental [illegible] was determined much earlier by G. K. Gilbert, a Wheeler surveyor. It is proper also to mention to the American Association for the Advancement of Science in 1883 the close [illegible] annual observations [illegible] y began at the west end while it was [illegible] low at the east, and he inferred that the land in that [illegible]

[illegible]

to the south. At points southwest of it are lowered, the
[illegible] are raised. The water, always following the sur-
face, could not always register the volume of the discharge at
changes.

Lake system is altogether southward of the source of the
ice, and the water is accordingly warmer at the shores. The annual

Minnesota Iowa 5 or 6 degrees per century

the consequent movement forward of the warm water surface is
for the mouth of the Detroit river on Saginaw bay. In Lake

As [illegible] the small steel [illegible] of the water is 4 inches per cen-
tury, at Milwaukee the estimated rate is 5 or 6 inches, and at
[illegible] between 6 and 10 inches.

These slow changes of mean water level are overlaid from
[illegible] variations of volume, but they are worthy of consideration
important to a large commercial city. The city of Chicago is located
[illegible] some [illegible] of protection are temporarily destroyed

Looking to the more distant future we may estimate the date [illegible]

[illegible] cago, as already mentioned, is an old channel made by the outlet of a glacial lake. The bed of the channel at the summit of the pass is about 8 feet above the mean level of Lake Michigan and 5 feet above the highest level. In 500 years [illegible]

[illegible]

1,000 years it will be continuous. In about 2,000 years the dis- [illegible]

[illegible]

western outlet at Chicago and the eastern at Buffalo. In 2,500 years the Niagara river will have become an intermittent stream, and in 3,500 years all its water will have been diverted to the [illegible]

Gulf of Mexico.

[illegible]

[illegible] ATION FOR THE ADVANCEMENT OF SCIENCE

If the British Association for the Advancement of Science has never yet done itself the honour of electing a geographer as its President, it at least is not open to the reproach of neglecting so important a department of knowledge as that which is concerned with the study of the earth and the natural conditions of its environment. Throughout its entire history of 77 years the Association has given geography a prominent place in its proceedings, and there have been few distinguished explorers who have not reserved some of their most interesting ac- [illegible]

[illegible] this body. Just 40 years ago, in the city of Bath, it was to see and hear Livingstone that people crowded into the hall assigned to Section E. Fifteen years later, at Brighton, before an equally large and brilliant assemblage, Mr Stanley narrated the thrilling story of his search for the great missionary-traveller in the wilds of equatorial Africa, and almost every Arctic ex- [illegible]

[illegible]

remote parts of the world

Dr Keltie's address was delivered on August 19, and in the

chair, at London, presented the six last reports of the Committees

Mr E. Delmar Morgan, of London, read a paper on Some Con-

tain Insects and a paper by Prof. Richard E. Dodge, of Columbia

A paper by Mr E. C. Jameson on 'The Ranges and the [illegible]' [illegible]

July and August is names of the Gurgeni and Awemal.

[illegible] of the [illegible] Science

of London, and The Duchess of Lands of Structure in Nature

Shortly after the reception of its number

by A. C. Haywood, spoke on the importance of geography as a

illustrative of geography in schools and colleges.

In the Section of Mathematics and Physics, on August

mathematic value. On the use of dye, in the section of Physiology,

by Agulla, in the Section of Mathematics and Physics, on

which the Report often to Climatology and Meteorology

In the Section of Meteorology, on August 24, Mr. F. Napier

[illegible]

visited Japan in June, 1896.

[illegible] to the geographer, especially on August 23, when the present [illegible]

[illegible] Contact, opened by Prof. F. W. Putnam, of Harvard [illegible]

[illegible] are of greatest value and are available for the purpose.

J. H.

[illegible] UNMAPPED AREAS ON THE EARTH'S SURFACE AWAITING THE EXPLORER AND GEOGRAPHER*

By J. Scott Keltie, LL. D.

Secretary to the Royal Geographical Society, Editor of the Geographical Journal and of the Statesman's Year Book, etc., etc.

We meet this year in exceptional circumstances. Thirteen [illegible]

[illegible] applies to the addition of the Section [illegible]

* Presidential address delivered before the Geographical Section of the British Association for the Advancement of Science at Toronto, August 19, 1897.

enterprises undertaken by any State, has been completed, and is [illegible] the mountains of Switzerland.

The most important desiderata, so far as pioneer exploration in Asia is concerned, may be said to be confined to two regions. In southern and central Arabia there are tracts which are as [illegible] as it is a sandy desert. At the same time it is, in the south [illegible] of rich cultivation and whose climate the late Mr Theodore Bent [illegible] and religious—which might be met with in a [illegible] pleasing story.

[illegible] the north and east. Lines of exploration have in recent years [illegible] Wellby and Malcolm. From the results obtained by these explorers we have formed a fair idea of the [illegible] the most extensive, and the most inhospitable plateau in the world. A [illegible] most interesting debates as to its geological history.

THE FORBIDDEN CITY

The region lying to the north of the Himalayan range and to the south of the plateau of Tibet is almost a blank on the map, and there is ample room here for the enterprising pioneer. The forbidden city of Lhasa is at present the goal of several adventurers, though as a matter of fact we cannot have much to learn in addition to what has been revealed in the interesting narrative of the native Indian traveller, Chandra Das. The maps fu-

cent mountain region on the north and east of it last furnishes a [illegible]

approached it from the east, through Szechuen, and they descrip- tion of the romantic scenery and the interesting non-Mongol in- habitants leaves us with a strong desire to learn more. On the south-east of Tibet is the remarkable mountainous region, con- sisting of a series of lofty parallel chains, through which run the upper waters of the Yangtse, the Mekong, the Salwin, and the [illegible]

probably does not reach far into the range. But it will be seen by a glance at a map that the upper waters of the other rivers are carried far into the heart of the mountains. That these upper- [illegible]

controversy. There is plenty of work here for the explorer, though the difficulties, physical and political, are great.

But besides these great unexplored regions there are many blanks to be filled up in other parts of Asia, and regions which, [illegible]

[illegible]. There is the mountain track between the Zerafshan river and the middle course of the Surkhab, a tributary of the Oxus, [illegible]

[illegible] having been inhabited, and that at no very remote period. It is almost surrounded by the Tarim, and on its eastern edge lies [illegible]

of recent investigation. As readers of Dr Nansen's Voyage of the Fram will remember, the Siberian coast is most imperfectly mapped. Of course it is a difficult task, but it is one to which the Russian government ought to be equal. Siberia has on paper [illegible]

fact our knowledge of its mountain ranges and of its great river courses is to a large extent extremely vague. All this awaits care- ful survey. In north-eastern Manchuria, and in many parts of [illegible]

river systems to be surveyed. In the Malay peninsula and in the great array of islands in the east and south-east of Asia—Su- matra, Borneo, the Philippines—much work still remains to be done. Thus for the coming century there will be no lack of

work for explorers in Asia and plenty of material to occupy the attention of our geographical societies.

UNMAPPED AFRICA

Coming to the map of Africa, we find the most marvelous transformation during the last sixty years, and mainly during the last forty years, dating from Livingstone's first memorable journey across the continent. Though the north of Africa was the home of one of the earliest civilizations, and though on the shores of the Mediterranean Phoenicians, Carthaginians, Greeks and Romans were at work for centuries, almost down to the nineteenth century of many of us, all the remainder of the continent, from the Sahara to the confines of Cape Colony, was supposed to be an unexplored blank. This blank has been filled up with surprising rapidity. Great rivers and lakes and mountains have been laid down in their main features, and the whole continent, with a few unimportant exceptions, has been parceled out among the powers of Europe. But much still remains to be done ere we can form an adequate conception of what is in some respects the most interesting and the most remarkable of the continents. Many curious problems still remain to be solved. The pioneer work of exploration has to a large extent been accomplished. Lines have been run in all directions; the main features have been blocked out; but between these lines the broad meshes remain to be filled in, and to do this will require many years of careful exploration. However, there still remain one or two regions that afford scope for the adventurous pioneer.

To the south of Abyssinia and to the west and northwest of Lake Rudolf on to the Upper Nile, is a region of considerable extent, which is almost practically unknown. Again, in the western Sahara there is an extensive area, inhabited mainly by the intractable Tuaregs, into which no one has been able to penetrate, and of which our knowledge is extremely scanty. Even in the central Sahara there are great areas which have not been traversed, while in the Libyan desert much remains to be done

and geological structure; but they deserve careful investigation, not only that we may ascertain their actual present condition, but in order also that we may try to discover some clue to the past history of this interesting continent. Still, it may at least be said that the great features of the continent have been so fully mapped during the last half century that what is required now

is merely the blunders of our maps. This is a process that re- [illegible]

[illegible]

quite recently an English traveler Mr Cowper found not far fro- [illegible]

[illegible]

on our maps. If only the obstructiveness of the Turkish officials could be overcome, there is a rich harvest for any one who wa- [illegible] to work with patience and intelligence. Even the interior of [illegible]

[illegible]

The French in both Tunis and Algeria are extending their knowledge southward.

EFFORTS OF THE POWERS

[illegible] are doing much to acquire a knowledge of their territories. Ger- [illegible]

[illegible]

the fauna, the flora, and the economic conditions. [illegible]

[illegible]

and the map of Africa is being gradually filled up. But what [illegible]

[illegible] work on the Great Rift valley is one of the most valuable contributions to African geography ever made. If men of this stamp would settle down in regions like that of Mount Ruwenzori or Lake Rudolf or the region about lakes Bangweolo and [illegible]

[illegible] the gains to scientific geography, as well as to the economic interests of Africa, would be great. An example of work of this kind is seen in the discoveries made by a young biologist trained in geographical observation, Mr Moore, on Lake Tan- [illegible]

[illegible]

Mr Moore [illegible] fauna, is essentially of a salt-water type. Mr Moore, I believe, is inclined to maintain that the ancient connection of this part of Africa with the ocean was not by the west, as Joseph Thomson surmised, but by the north, through the [illegible]

[illegible]

careful examination of Lake Tanganyika as the crucial test of his

kely to provide results of the highest importance.

CLIMATE OF THE FUTURE

But there are other sporting problems connected with Africa to

development of Africa, but the products of acclimatement. The

plorers of the ancient world. Colonial Post Control Africa was a

generalities, and there we look forward to the exact results

to-day. We can only go to work experiment daily and week by

solve the problem of acclimatement when we have the exact fig-

ve opinions of those who have had actual experience of African

of work in tropical Africa, it will never be possible to call white

an Indian.

So far, most, and experience has shown that white people

can hope to settle in Central Africa as they have settled in

mbia and the United States and in Australia, and make it a per-

anent and a home for new generations. Even in such favourable

localities they do not become acclimatised at once, they must go

through a certain process of

nally. No doubt they can ever become the true natives of

people of the old races have to be sent away to be reared. Still,

at we have our experience in Africa is limited. It has been

monstrated that white men can be preserved to old age, if they will

NORTH AMERICA.

I have dwelt thus long on Africa, because it will really be one of the great geographical problems of the coming century. Had there been evidence of Americans or Australians, we may be sure it would not have remained so long unexplored by the European peoples at last upon it. Central Africa, just as it had been extensively peopled, and yet its Niger-problem was be-

way into the interior Columbus and Cabot discovered a new

with its waves. Thus did successive peoplings long ago ob-

ed years ago and the exploration of Africa, which has been known to Europe and Asia long before the beginning of history. During these four years North America at least has been very thoroughly explored. The two great nations which inhabit North America

unfortunately for the commercial and territorial prosperity, the natural resources.

done by the survey of Canada under Sir William Logan, for

fying them that under the Imperial department, except to-

the productiveness. Still, though nature has been stern, human re-

sources in the future. There are large areas which have not as yet been thoroughly explored. Within quite recent years we have and have now added at least to us by the work of Dawson, Lord

on the Yukon, De Bolt on the region to the south of Hudson Bay,

by the border in Tyrrell in the barren lands on the west of Hudson Bay, by others beyond the sources of the Mackenzie and by Low in Labrador.

But it is not so long since that De Bonvouloir, on reviewing the work

previous to his departure, thought it worth while to express

expedition pointed out that something like a million square

miles of its territories to be magnificent. Apart from the rich mineral

deposits in the north, there are the Hudson Bay and the

unknowable areas which are thought to be suitable for agriculture

and land, the extent of which we know little about, and

those which have been recently explored and which

UNITED STATES

[illegible]
importance.

CENTRAL AND SOUTH AMERICA

It is when we come to Central and South America that we find ample room for the unofficial explorer. In Mexico and the Central American States there are considerable areas of which we have little or only the vaguest knowledge. In South America there is really more room now for the pioneer explorer than there is in Central Africa. In recent years the Argentine departmental [illegible] territories, where a certain amount of good work has been [illegible] [illegible] [illegible] [illegible] explorers. Along the great river courses our knowledge is [illegible] [illegible] [illegible] affluents, lying between the rivers are almost unknown. In Peru [illegible] [illegible] [illegible] the Rio Negro we have much to learn, while on the West Coast [illegible] [illegible] [illegible] systematic exploration is wanted, exploration of the character [illegible] [illegible]

There is an enormous area lying to the east of the northern [illegible] [illegible] [illegible] [illegible] [illegible] lying between the Rio Negro and the Atlantic is but little known. [illegible] [illegible] [illegible] [illegible] [illegible]

In short, in South America there is a wider and richer field for exploration than in any other continent. But no more such [illegible]

[illegible] ought to be able to [illegible] satisfactory information on the geology of this country traversed, and of its future geological history in former epochs are of the highest interest. Moreover, we have here the remains of ancient civilizations which [illegible] patient investigation.

CENTRAL A

The most important element of Australia is in the hands of men of the native race as [illegible] who have developed to [illegible] characteristics of that race [illegible]. The five colonies which [illegible] lining the [illegible] of the [illegible] of the [illegible] of the [illegible] able. [illegible] has been explored by explorers, at the [illegible] there with spinifex and scrub which [illegible]. There are [illegible] for essentially from those which have been found along the routes that have been explored [illegible] Many [illegible] rivers that have [illegible] as [illegible] with [illegible] look for the richest results in the future. There remains much

[illegible]

from there is an immense store of water. In one or two places in

[illegible]

Wales, this supply has been tapped with satisfactory results;

[illegible]

POLAR EXPLORATION

[illegible]

the North Pole problem—so far, at least, as the Old World side of the Pole is concerned. That some one will reach the Pole at no distant date is certain; Nansen has shown the way, and the legitimate curiosity of humanity will not rest satisfied till the goal be reached. But Arctic exploration does not end with the attainment of the Pole. Europe has done her share on her own side of the Pole, want about the side which forms the hinter-

[illegible]

bergen, Franz Josef Land, Nova Zembla, and the New Siberian Islands. To the north of America we have an immense archipelago, the actual extent of which is unknown. Sverdrup and

[illegible]

do for that half of the North Polar region what Nansen has done

[illegible]

there than we find it even on our maps. Whatever be the cause, it is important, in the interests of science, that this section of the

[illegible] all round the Pole.

It is stated that Sir Garnet Lowry has organized a

[illegible] Let us hope that he will be able to carry out his

[illegible] Meantime should Canada [illegible] the undertaking [illegible] and the standing of a great and prosperous nation who has at once the most [illegible] and the most [illegible]

[illegible] of other countries has proved to be of a high order, and has made the long [illegible] of a literature and an art of our own.

[illegible] contribute to [illegible] the name of Great Britain is [illegible] than these enterprises which [illegible] have sent out from

[illegible] between here and the Pole? I venture to throw out these

[illegible] glory of the great Canadian [illegible]

THE ANTARCTIC REGIONS

Not only has an interest in Arctic exploration been revived, but a [illegible] Europe at large has shown greater interest than ever in the exploration of the region around the opposite Pole of the earth of which our knowledge is so scanty. Some [illegible]

[illegible] which surround the North Pole. Instead of an almost unbroken [illegible]

[illegible] it is [illegible] we have a fairly adequate idea of what

are the real ice floors. We want to know what is the extent of most land, what are its glacial problems, what part it has played in the geology, what are its mineral resources, what part it has played in past ages? We know there is one lofty, active volcano. Are there any others? Many of the problems of terrestrial magnetism are connected with the Antarctic area, and a scientific examination of the region is required to be undertaken and carried out as far as possible, that is, temperature, ice, and land. We have here, in short, the finest extensive, next to the area on the surface of the globe

plete the work begun by those sixty years ago, and to supplement

plan an enterprise which might involve the services of a few naval officers and men. We need not mention this matter; but

separated men for an Antarctic exploration under its own auspices. It is felt that Antarctic exploration is peculiarly the

task is one of the greatest geographical problems of the future,

to-day. It may be mentioned that a small and well-equipped

out on a large scale.

still our duty we have to deal not only with the lands of the

that is shown, so far as most we have to deal with the commercial. The exploration of terrestrial magnetism, by a number of new stations, in-

sland. It would be good to have one's daily note-taking with the famous voyage of the *Challenger*. There had been an exhaustive investigation before that, but on a very limited scale.

[illegible] not we have been able to obtain any [illegible]

[illegible] the exact amount of movement, if [illegible] of

[illegible] land and of the movement of the water, which causes it. The [illegible] of [illegible] may

[illegible] Dead a Marrow twenty years to bring out.

[illegible] to the sea, [illegible] to the sand. It is only

the attention they deserve.

[illegible] especially [illegible] subject of special investigation by

[illegible] a special English river system [illegible] work in the [illegible]

[illegible] In [illegible] Germany and the Russian special attention is given

[illegible]

[illegible] Lawrence [illegible] formed in [illegible] an official publication.

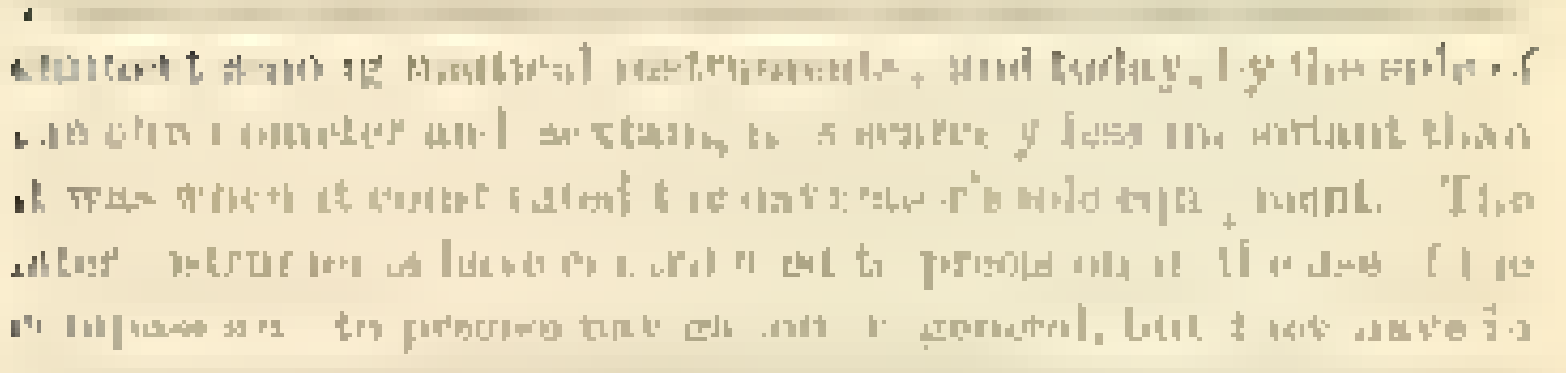
THE COMPASS IN MODERN NAVIGATION

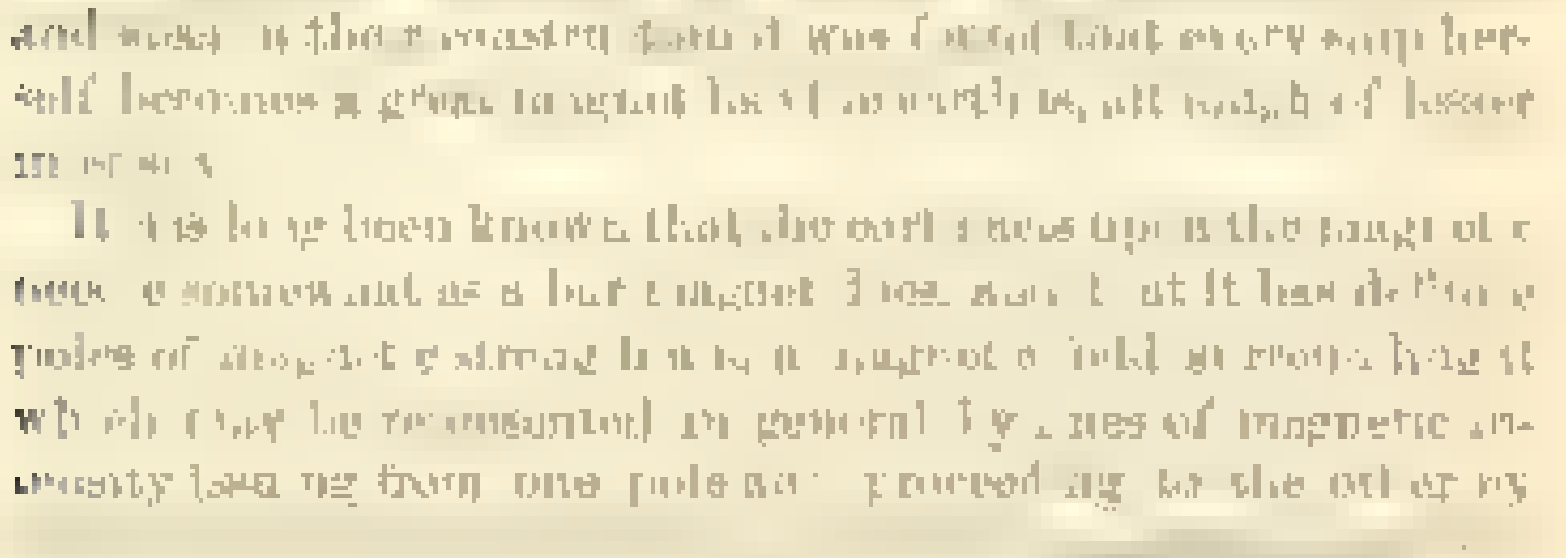
by G. W. Littlehales.

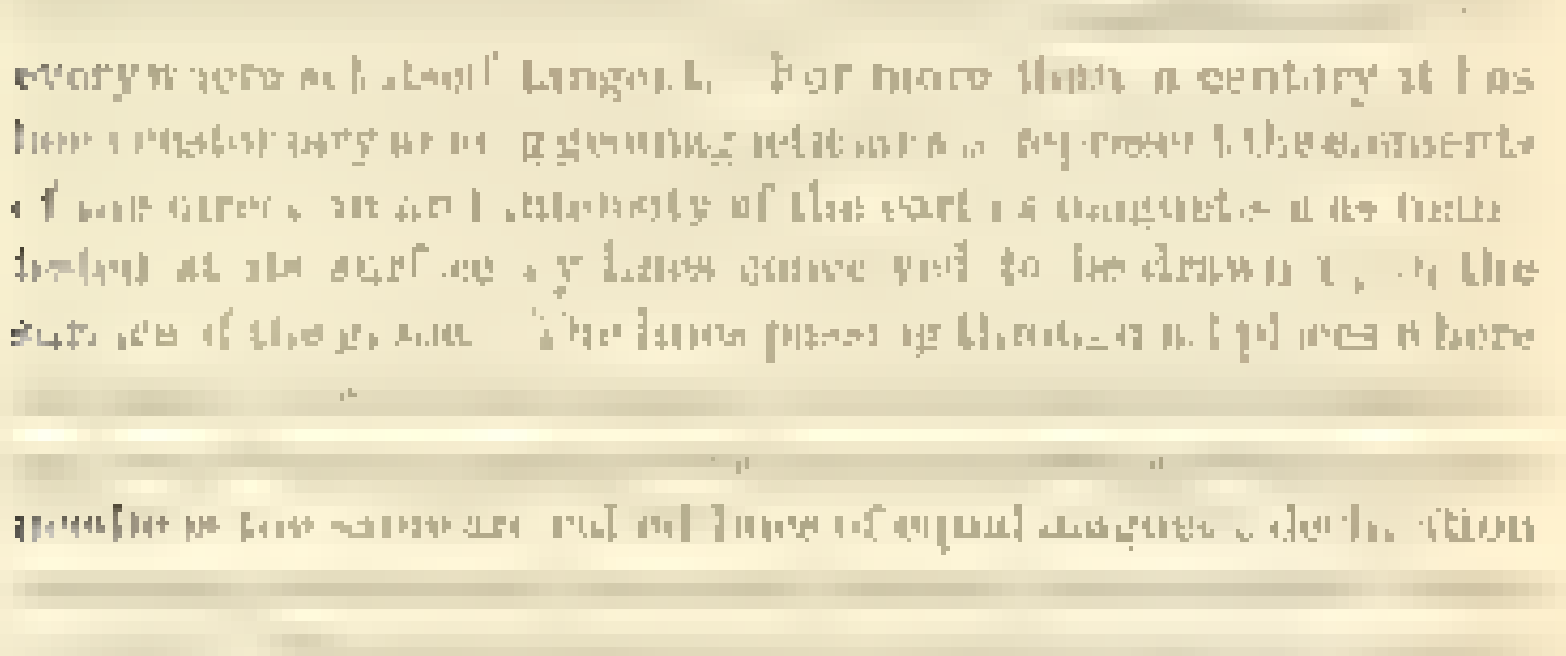
U. S. Hydrographic Office

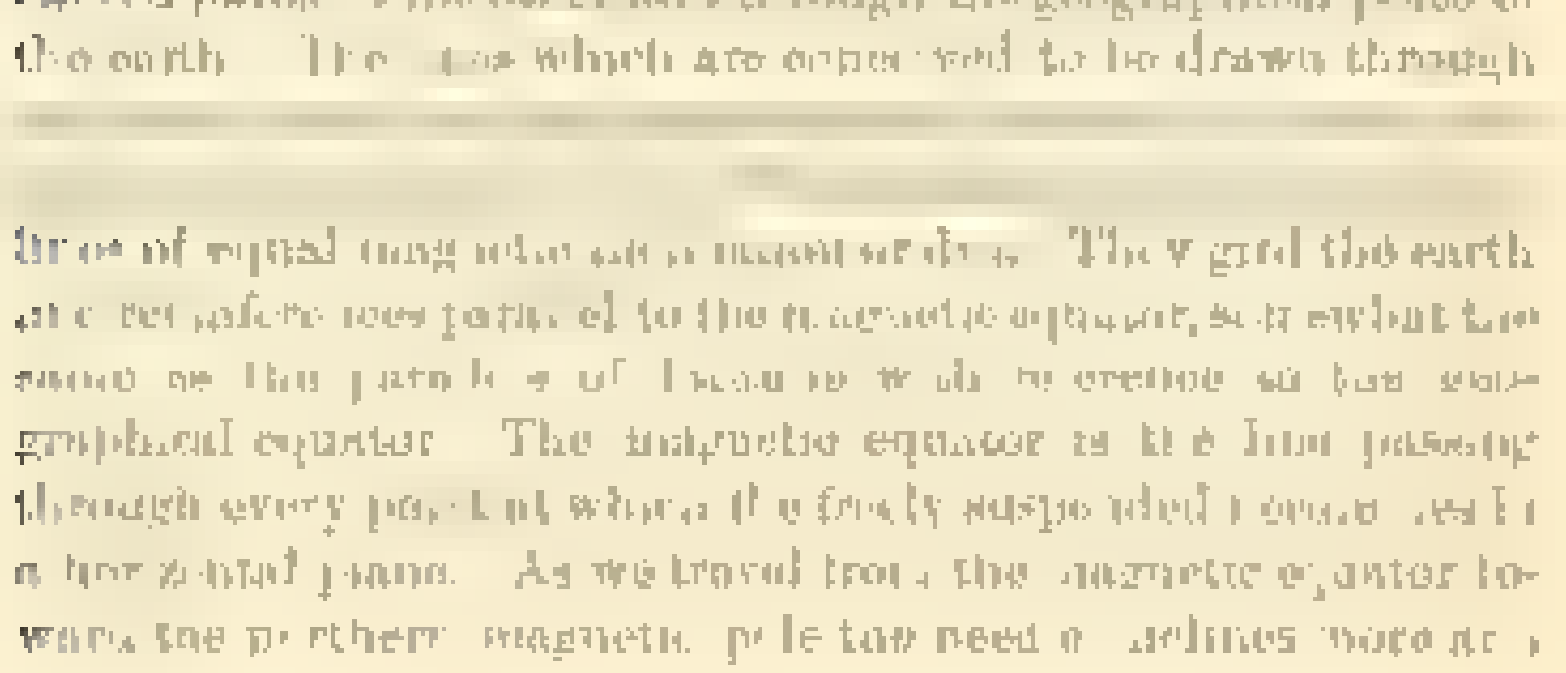
Transoceanic navigation, with all that it has been to the [illegible] of the world and the development of the civilization of [illegible]

[illegible] the extent of the importance of the compass to human affairs.









[illegible]

The great hermit world is a part of the subconscious mind, but it is also a part of the physical world. It is a part of the physical world that is not known to the average person. It is a part of the physical world that is not known to the average person. It is a part of the physical world that is not known to the average person.

It is not necessary to understand the physical world in order to understand the physical world. It is not necessary to understand the physical world in order to understand the physical world. It is not necessary to understand the physical world in order to understand the physical world.

small body move and become a portion of the great mind of the great section of the earth and the hermit and with every

phenomena will become a new realm of poetry. It is a real experience but a projection of the magnetic mind of the earth, and the hermit of the magnetic mind of the earth. The hermit of the magnetic mind of the earth is a projection of the magnetic mind of the earth, and the hermit of the magnetic mind of the earth is a projection of the magnetic mind of the earth.

It is a strange fact that the hermit of the magnetic mind of the earth is a projection of the magnetic mind of the earth, and the hermit of the magnetic mind of the earth is a projection of the magnetic mind of the earth.

and is not only free from danger but is held sacred by the hermit of the magnetic mind of the earth, and the hermit of the magnetic mind of the earth is a projection of the magnetic mind of the earth. If a hermit of the magnetic mind of the earth is a projection of the magnetic mind of the earth, and the hermit of the magnetic mind of the earth is a projection of the magnetic mind of the earth—a

when that hermit becomes a magnetic mind of the earth, and the hermit of the magnetic mind of the earth is a projection of the magnetic mind of the earth.

[illegible] of the earth, and the hermit of the magnetic mind of the earth is a projection of the magnetic mind of the earth. The hermit of the magnetic mind of the earth is a projection of the magnetic mind of the earth, and the hermit of the magnetic mind of the earth is a projection of the magnetic mind of the earth.

[illegible] the hermit of the magnetic mind of the earth is a projection of the magnetic mind of the earth, and the hermit of the magnetic mind of the earth is a projection of the magnetic mind of the earth.

[illegible] northward, so will the north pole shift to the west how the action

[illegible] become a diagonal from starboard bow to port quarter. When the ship heads eastward the current strikes her on the port quarter, the pole will be north, and the neutral line takes a position from starboard quarter [illegible] to the

[illegible] are reversed, but this time it is the stern that is a north pole, while the bow is a south pole. At west the conditions at east

[illegible] reverse and the ideal ship is a ship that

[illegible] have the ideal of a "soft" iron ship and contrast to the

[illegible] characteristic as that makes it as permanent and well defined a

[illegible] of her magnetism.

An iron ship, with her frames, planking, decks, beams, knees, etc.,

[illegible] and necessary alignment with the hull. However

[illegible] analytical investigation to test it results to enable the

[illegible] compass. The effect may be considered as taking place in three

Almost all the structural iron of a ship is symmetrically ar-

found similarly disposed on the port side; and the problem is simplified to pairs of parallel forces, each pair having its resultant parallel to one of the coördinate axes. The effect of every magnetic particle, whether of permanent or induced magnetism, may be reduced to this condition. If the sum total of all the magnetic forces parallel to each coördinate axis be transferred to it, and the whole be conceived to be concentrated upon the north point of the compass-needle, the entire magnetic power of the ship may be compared to that of three imaginary compound-magnets—one laid horizontally in the axis of X; the second, also horizontally, in the axis of Y, and the third, vertically, in the axis of Z. By steaming around a circle in the open sea and observing the compass bearing of the sun with the ship's head on equidistant compass courses, and also, at the same times, the astronomical bearings of the sun, the magnetic effect of the ship—that is, of the three imaginary compound-magnets in the axes of X, Y, and Z—which causes the needle to deflect from the magnetic meridian by different angles at the different headings, can be immediately found, if the variation of the compass due to the geographical locality is known. As the ship makes a complete circle in azimuth, the north end of the needle is drawn sometimes to the right hand of the magnetic meridian and sometimes to the left hand; in the former case the deflection is called east deviation and in the latter west deviation. A table of these deflections, serially arranged, is called a table of deviations of the compass. The harmonic analysis of such a table of deviations consists in representing each of the elementary magnets, whose effects contribute to make up the imaginary compound-magnets, as a separate disturbing cause whose effect upon the compass needle may be represented by a constant multiplied by a simple harmonic function of the compass-azimuth of the ship's head. Adding together the effects of the different disturbing causes, thus represented, and placing them equal to the deviation observed on a certain heading of the ship, a conditional equation may be formed for each of the headings upon which the deviation was observed.

From such a series of conditional equations normal equations may be found by the method of least squares, and from them the harmonic constants which represent the elementary disturbing magnets. Thus it is that from the effect an intelligent comprehension of the cause may be gained.

With these coefficients a navigator may compute beforehand

the value of the deviation to which his compass will be subject on any heading of the ship; but in making long cruises and passing into different magnetic latitudes they require unceasing attention, because some of them represent the effects of the induction of the earth's magnetic field upon the "soft" iron of the ship, and as the ship sails the ocean she passes through ever-varying fields of terrestrial magnetism. Her own magnetism is also undergoing continual, though small, changes due to the wrenching and straining of the ship by the action of the sea. Yet, by examining thoroughly into the harmonic coefficients and by considering the known values of the elements of the earth's magnetism, a careful navigator may predict a table of deviations for his ship and compass in any part of the world.

He will then understand and be prepared for such changes in the ship's magnetism as arise from the heeling of the ship, from change in geographical position, and from alteration in the course after the ship has remained for a long time on one heading, and he may navigate his vessel with the confidence and security that he would have in a wooden ship, for he can at any time correct the course steered by the compass so that the magnetic course actually made good may be laid down upon the chart or used in the calculation of the ship's reckoning, he can correct bearings of the land by the amount of deviation due to the direction of the ship's head at the time they were taken, and if he wishes to shape a course for a port, having found by calculation or from the chart the correct magnetic course to be made good, he can so apply the deviation as to obtain the compass course to be steered.

In many modern ships the deviations are largely reduced by introducing magnets into positions near the compass to compensate for the effects of the ship's magnetism. The analysis of the table of deviations shows that the polar forces acting in the ship may be represented by imaginary magnets, and it is, therefore, certain from well known laws of magnetic action that the effects of these disturbing forces may be neutralized by introducing real magnets whose forces have the same magnitudes but act in the opposite directions.

The proceedings of the British Association at Toronto were admirably reported by the local press, the daily reports of the *Globe*, together with a finely illustrated supplement, aggregating nearly 150 columns, or the equivalent of an octavo volume of 350 pages of long primer.

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